RCRA FACILITY ASSESSMENT
SHELL OIL COMPANY MARTINEZ MANUFACTURING COMPLEX
MARTINEZ, CALIFORNIA

EPA Region 9 I.D. Number CAD009164021

Submitted to:

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EPA Contract Number 68-01-7374
Kearney Work Assignment Number R29-07-01
SAIC Project Number 2-817-08-079-00

February 1988

3.0 ENVIRONMENTAL SETTING

3.1 LOCATION AND SURROUNDING LAND USE

The Shell Oil Company Martinez Refinery is located adjacent to the community of Martinez, California on the south shore of Carquinez Strait and Suisun Bay, approximately 35 miles northeast of San Francisco on 1000 acres of land in Contra Costa County (Figure 1). The areas surrounding the refinery to the west, south and southeast are generally residential and light industrial. A PG&E power plant is located immediately west of the facility and the Mountain View Sanitary District operates a wastewater treatment facility on the eastern edge of the refinery. Undeveloped marshland, and open water border the facility to the north and northeast.(17) The facility occupies a portion of T2N, R3W, MBD&M. Section lines in the vicinity of the refinery are irregular and generally only border developed areas. The sections in the area are not numbered.

3.2 TOPOGRAPHY AND METEOROLOGY

The local topography varies from hilly south of and onto the refinery site, to tidal flats north and northeast of the facility (Figure 2). Elevations on the site range from sea level on the tidal flats to approximately 215 feet MSL in the southern portion of the site. In general, the topography slopes from the south to the north in the direction of Carquinez Strait.

The climate in the area surrounding the Martinez facility ranges from mild to moderate throughout the year. A high daily average temperature of of 70°F occurs in August, and a low daily average temperature of 42°F occurs in January. Temperatures above 90°F average 10 days per year, while temperatures below 32°F also average 10 days per year. The average annual precipitation is 18 inches. A majority of the precipitation occurs from November through February. Snowfall does not usually occur in this area. Potential evapotranspiration averages approximately 55 inches per year. Less than 10 percent of the precipitation in this area is thought to recharge groundwater, with the remainder forming surface runoff. Local man-made topographic features such as ponds and dikes may allow greater than normal groundwater recharge to occur.(17)

The prevailing wind direction at the Martinez refinery is from the northwest at a speed of 5-10 miles per hour.(4) A wind rose for the facility is shown in Figure 12.

3.3 SURFACE WATER AND FLOODPLAIN

There are no natural perennial surface waters which traverse the Shell Martinez facility site (Figure 2). As described by Stanley (17), the complex itself is divided into two watersheds. Surface and process waste waters in the west watershed are collected by the sewer system which drains to the effluent treating area north of Marina Vista Boulevard (Figure 2). Process waste waters in the east watershed are discharged to the gross oil separator and then pumped to the west watershed for additional treatment. Storm (surface) water in the east watershed is diverted to the storm ponds equipped with oil baffles and weirs. After separation, the water is discharged through ditches, eventually entering Suisun Bay at Bulls Head Point.

The facility is not within the 100 year flood plain as the 100 year flood level is 6.5 feet above the mean sea level datum of the 1929 of the U.S. Coast and Geodetic Survey.(4)

3.4 GEOLOGY AND HYDROLOGY

The Shell Martinez petrochemical complex lies on the eastern edge of the Berkeley Hills, which are part of the Coast Range Province and are characterized by highly deformed sedimentary rocks ranging from Eocene to Upper Cretaceous in age. Underlying rock units increase in age from west to east. The Domengine Sandstone outcrops in the western and central portions of the facility and is generally classified as a tan, arkosic sandstone, with some shale interbeds. Members of the Martinez Formation outcrop in the central and eastern portions of the complex and they range in nature from shales to fossiliferous, conglomeritic sandstones. Basement rock in this area consists of the Franciscan Assemblage.(17)

Detailed mapping of the site and vicinity by Harding-Lawson Associates (24) revealed a number of small northeast striking faults within the facility site but no major faults which traverse the refinery property. Seismic activity in

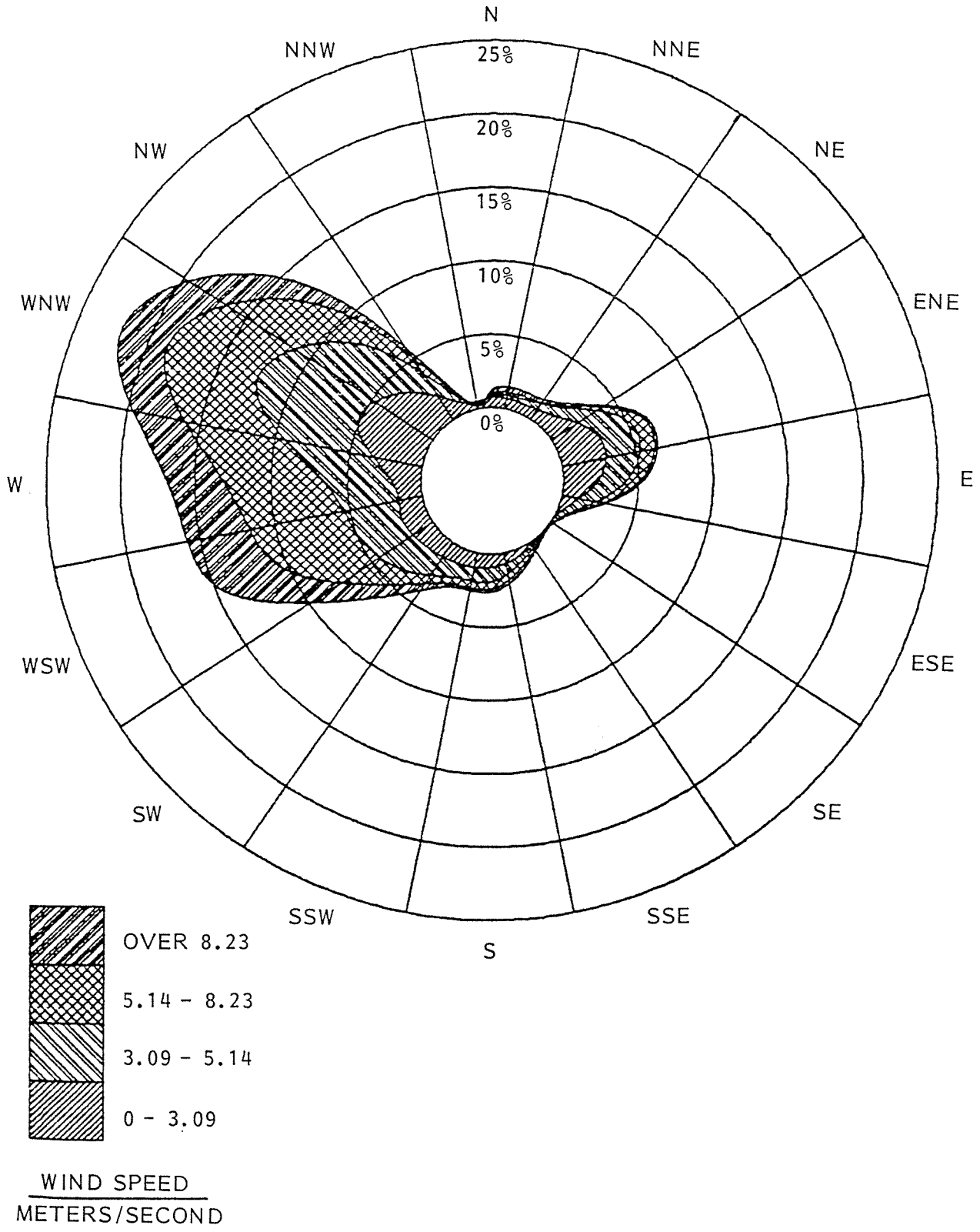

Figure 12

WIND ROSE - MARTINEZ MANUFACTURING COMPLEX
Source: Part B Permit Application

the area is directly related to activity along the San Andreas Fault System which includes the Hayward Fault, the Calaveras Fault Zone, the Concord Fault, and the Antioch Fault. The Concord Fault is located less than two miles to the east and exhibits recent movement with a maximum recorded earthquake magnitude of 5.4 (Richter). The Calaveras Fault System (Franklin and Southampton Faults) is located approximately two miles to the west of the facility and is also classified as active. This fault system has a maximum recorded earthquake of magnitude 6 with a recurrence rate of 10-100 years for magnitude 6. Other faults related to the San Andreas Fault System may influence the study area, but would probably not have a larger impact than the Concord Fault or the Calaveras Fault System. The minor faults located within the facility are classified as inactive, but if large displacement and ground acceleration were to occur due to a major earthquake, compensating displacement could occur along the fault lines. Groundwater levels generally fluctuate before an earthquake due to strain within the formations.(17)

The Shell Martinez facility is located within the San Francisco Bay Hydrologic Study Area and is bounded on the east by the Ygnacio Valley Groundwater Basin and on the west by the Arroyo del Hambre Groundwater Basin. Due to the limited occurrence of groundwater beneath the facility the area is not designated as a groundwater basin. Several unnamed aquifers occur beneath the facility but are extremely limited in areal extent and water yield. Groundwater beneath the facility occurs in several modes including: 1) in interconnected pores and fractures within the bedrock hills, 2) temporarily or seasonally within alluvial deposits and localized fill which overlies bedrock, 3) within the unconsolidated alluvial fill which blankets the lower elevations, and 4) within the pore spaces of the low permeability bay muds which occur near Carquinez Strait and Suisun Bay.(15,17) Groundwater beneath the Shell Refinery, both shallow and deep, is brackish and limited in available economic quantities. Therefore, groundwater is not utilized as a domestic or industrial supply source.(14) The groundwater basins which border the facility on the east and west however, are used as water supply sources.(17)

Groundwater beneath the site is recharged primarily from the surrounding hills. Water percolates downward through pore spaces and fractures until it reaches the water table where the flow is then governed by hydraulic gradients

as the water moves to areas of lower potential at the base of the hills. Many of the unconsolidated alluvial sediments which occur at the bases of the hills are less permeable than the bedrock of the hills and retard the flow of groundwater. As recharging groundwater from the bedrock encounters the less permeable alluvial sediments a mounding of groundwater occurs. During periods of high rainfall water level fluctuations of over 25 feet have been observed in some wells and in the presence of seeps along the flanks of the hills. During the months of little or no precipitation, mounding decreases as groundwater flows to the surrounding alluvial sediments. Groundwater within the alluvial sediments in turn discharges to ponds, creeks, and marshlands in and surrounding the facility as well as to Carquinez Strait and Suisun Bay. Groundwater flowing beneath the western property line of the facility discharges to the Arroyo del Hambre Groundwater Basin, whereas groundwater flowing east from the facility discharges to the Ygnacio Valley Groundwater Basin. Groundwater which flows north from the central portion of the refinery complex discharges to Carquinez Strait.(17)

3.5 GROUNDWATER CONTAMINATION

Since 1975, 147 groundwater monitoring wells have been installed throughout the Shell Martinez facility. Petroleum product has been detected floating on the groundwater in 39 of the 147 monitoring wells. The floating product is of concern in seven specific areas within the facility because of the thickness of the product in the wells and/or the amount of product that has been calculated lost by Shell.(23) Shell has delineated two "major" product plumes and four "moderate" size product plumes as well as many areas of residual product contamination.(17)

Approximately 15,000 barrels of crude oil, specific gravity 0.92, are located in a plume between Reservoirs #1, #2, and Lake Slobodnik. These reservoirs are located in the approximate center of the refinery complex (Figures 7 and 8). This plume has been detected in several wells at thicknesses up to 20 feet.(23) A second large product plume has been detected at Crude Hill (Figure 6). This plume contains at least 5000 barrels of jet fuel, specific gravity 0.84, and it is moving west-southwesterly.(17) The four "moderate" size plumes all appear to result from tank spills and leaks and one from the fire training area.(17)

4.0 DESCRIPTION OF INDIVIDUAL UNITS

4.1 INACTIVE LAND TREATMENT AREA "FF"

4.1.1 Information Summary

Unit Description: This inactive land treatment area is located on the edge of a tidal marsh on the northwest end of the facility property (Figure 5).(2,10) Located just northeast of the wastewater treatment system, the unit is also referred to as the sludge treatment ponds and designated as Unit "FF" in facility correspondence.(1,2,4) This area was used for drying sludges, which were removed from the wastewater equalization ponds (Unit 4.32) on two occasions between 1975 and 1976.(1,2) According to the facility, the dried sludges were mechanically removed from the site and transported to an approved hazardous waste disposal facility.(2,5) The site is now occupied by three stormwater retention ponds (Unit 4.66) which have been in use since 1985.(29)

The land treatment area consisted of three ponds, each with an area of between three and five acres.(1,10) The ponds were separated by intermediate dikes; the entire land treatment area was surrounded by a perimeter dike.(10) The total capacity of this land treatment area was 13,000 cubic yards.(1) The unit operated under a CRWQCB permit in 1975 and 1976.(1,2)

Use of this site for sludge drying discontinued in 1976 when the California Department of Fish and Game and the U.S. Fish and Wildlife Service determined that the site was a wetland.(6) Shell proposed to use the site again in 1982 for sludge drying and submitted the required permit applications to appropriate regulatory agencies.(5,6) These permit applications included a waste discharge permit application from the California Regional Water Quality Control Board (RWQCB), and RCRA Part A and Part B applications to the California Department of Health Services (DOHS) as the sludges were classified as a hazardous waste.(4,6,7) In 1983, the RWQCB issued a Waste Discharge Requirement for the site which required an investigation to determine if prior use of the site for sludge drying allowed migration of waste materials beyond the containment dikes.(4,8) Additionally, the DOHS issued an Interim Status Document for the site in 1981.(6,9) However, since 1976, the site was never used again for sludge drying.

The dried sludges were removed from the site and transported to an off-site disposal facility. No soil excavation or capping activities occurred at the site.(25)

Date of Startup: The unit was placed into service for sludge drying in 1975.(1) The unit became active as stormwater retention ponds (Unit 4.66) in 1985.(29)

Date of Closure: This land treatment area became inactive as sludge drying ponds in 1976.(1) The stormwater retention ponds are still in use.(25)

Wastes Managed: Sludges have been collected from the wastewater equalization ponds and analyzed for metals, oil and grease, pesticides, and PCBs.(4) Sludge samples analyzed by the EP Toxicity Test Procedure were found to contain metals in concentrations below the EP Toxicity limits.(4) Using the California Waste Extraction Test, the sludge samples were found to contain lead, nickel, and zinc above the listed soluble threshold limiting concentrations.(4) Samples analyzed using an acid digestion/atomic absorption procedure were found to contain significant concentrations of chromium and lead.(4) It was not clear from the presentation of the analytical results whether pesticides or PCBs were present in the sludges.(4) EPA Region 9 considers these sludges to be a listed waste (K051) due to high metals concentrations.(11,12)

Release Controls: The land treatment area is surrounded by a six foot high perimeter dike with each pond separated by intermediate dikes.(10) The dikes were constructed in 1970 of predominantly brown silty sand with some brown sandy silt.(5,10) The dikes have been constructed to withstand water levels associated with a 100 year flood.(15) However, the dikes do not provide adequate lateral containment since portions of the dikes contain highly permeable materials.(6,10,13) Vertical containment is provided by underlying natural bay muds (gray clayey silt) in thicknesses over five feet throughout most of the land treatment area.(6,10,14)

History of Releases: The facility conducted a site investigation of the sludge drying ponds in compliance with their Waste Discharge Requirements.(8) The investigation included collection and analyses of soil and groundwater

samples to determine if migration of waste materials beyond the dikes occurred.(8) Based upon this investigation, elevated levels of chromium were found in soil borings collected along the western and southern perimeter of the land treatment area.(8) In addition, high concentrations of petroleum hydrocarbons were noted in soil borings collected along the western side of the unit.(8) Groundwater quality did not appear to be affected by prior use of this site as a sludge drying area, based on the results of this investigation.(8)

The area formerly occupied by the sludge drying ponds was inspected during the VSI. The site is now occupied by stormwater retention ponds (Unit 4.66), two of which contained water. As a result, any past releases occuring from the sludge drying ponds were not readily observable.(25)

4.1.2 Conclusions

Soil/Groundwater Release Potential: It appears that past releases of hazardous constituents to the soil from this land treatment area have occurred, based on a Shell site investigation report.(8) Although the wastes were removed from the site, no excavation of contaminated soils has occurred. As a result, there is a high potential for ongoing releases to soil. Based on the results of the site investigation report, groundwater quality was not apparently affected by prior use of the site.

Surface Water Release Potential: There is a high potential that past releases to surface waters occurred from this unit as portions of the perimeter dikes contained highly permeable materials, thereby providing inadequate containment, and due to the location of the unit in a marshland. There is a moderate potential for ongoing releases to surface water as the contaminated soils have not been removed from the unit.

Air Release Potential: Past air releases of the volatile components of the sludges probably occurred based on the design of the ponds as solar evaporation units. Although contaminated soils remain in the unit, there is a low potential for ongoing air releases.

Subsurface Gas Release Potential: If anaerobic conditions occurred in the subsurface environment, there is a potential that methane gas may have been generated in the past from this unit due to the presence of hydrocarbons in the soil. There is low ongoing potential for the generation of subsurface gas as hydrocarbon-contaminated soils remain in the unit.

4.2 INACTIVE UNIT "H"

4.2.1 Information Summary

Unit Description: This inactive sludge holding pond is located on the northwest end of the facility property near the facility's wastewater treatment system (Figure 5) and is designated as Unit "H" in facility correspondence.(1, 2,3) This unit is shown in Photographs 56, 57, 58, and 59 in Appendix A. The unit was used for treating and disposing of oily wastes produced during early refinery operations.(1,3) The landfill was deactivated and wastes were removed in 1965 when Tank 1161 was constructed.(1,3) Some of the wastes removed were placed in inactive landfill "X" (Unit 4.10) and some were collected by the Central Contra Costa Sanitary District.(1) This 2-acre unit comprised a 15-foot deep sludge pond. Following sludge and residue removal, the unit was backfilled in 1966 and compacted. Tank 1161 now occupies about 3/4 acre.(25)

Date of Startup: This unit was placed into service in 1920.(1)

Date of Closure: The sludges and underlying bay mud clays were removed in 1965.(30)

Wastes Managed: The landfill received oily wastes from early refinery operations. The landfill may have also received acid sludges and sludges containing lead.(1) Chemical analyses were not available for this review, although it is expected that the oily wastes contained 40 CFR 261, Appendix VIII constituents, typical of complex hydrocarbons.

Release Controls: No information on the unit's release controls when active was available for this review. The unit is now surrounded by nine-foot high embankments, and is backfilled with approximately 12 feet of compacted soil.(30)

History of Releases: Four soil borings (H-1 to H-4) were collected within this inactive landfill as part of a waste site investigation conducted by Shell.(3) The borings ranged from 6 to 11.5 feet in depth and yielded nine samples.(3) Samples were analyzed for metals, chloride, sulfate, sulfide, pH, and total organic halogens (TOX).(3) Of the metals listed in 40 CFR 261,

Appendix VIII, barium, chromium, nickel, and lead were detected in the soil samples.(3) In addition, TOX was also detected.(3) High sulfate levels and low pH, possibly indicating the presence of sulfuric acid, were also found in the soil samples.(3) Hydrocarbons were observed from 10-10.5 feet in boring H-1.(29) The facility's SWAT report indicated the presence of hydrocarbons as evidence of wastes present and the elevated sulfate and low pH as "possible influence of wastes containing sulfuric acid."(29) Groundwater samples from one downgradient well have shown no contamination.(29)

The area formerly occupied by this landfill was inspected during the VSI. The area is now occupied by Tank 1161, and as a result, any past releases which may occurred from the landfill were not readily observable.(25)

4.2.2 Conclusions

Soil/Groundwater Release Potential: Soil releases have occurred from this unit. Based on sampling evidence, there is a low potential for ongoing releases to subsurface soil and groundwater from this unit.

Surface Water Release Potential: The unit is closed, covered, and surrounded by embankments. There is no ongoing release potential. Not enough information is available regarding the configuration of the unit when active to determine the potential for past releases to surface water.

Air Release Potential: While active, the unit probably had a high potential for air releases of volatile compounds from oily and acidic sludges. There is no apparent potential for air release as wastes have been excavated, and the unit is closed and covered.

Subsurface Gas Release Potential: There is a low potential for the generation of subsurface gas from this unit due to the presence of hydrocarbons in boring H-1.

4.3 INACTIVE LAND DISPOSAL AREA "I"

4.3.1 Information Summary

Unit Description: This inactive land disposal area is located on the northwestern portion of the facility property, near wells 38 and 94, at the present location of a tanker truck filling station and parking lot (Figure 6).(2,25, 30) This land disposal area is designated as Unit "I" on facility correspondence.(1,2,3) This unit is shown in Photographs 60, 61, 62, 63, 64, and 65 in Appendix A.

This area was used for the collection of tank and process area drainage and acid sludges prior to 1923.(1,3,30) The land disposal area is also believed to contain tetraethyl lead, asphalt sludges, and tar sludges.(1,3) In past refinery drawings, this unit has been labeled as an oil drumming operation and sludge pit.(16) This area has been covered over with asphalt and concrete and is currently used as a truck loading rack.(16) The unit measures about 1,000 ft x 400 ft with a depth of approximately 11 ft.(30) According to the facility, wastes were solidified in 1923, and structures constructed over the area. The entire area is now paved.(30)

Date of Startup: The landfill became active at an unknown date; the most recent reports from Shell do not indicate a startup date.

Date of Closure: The unit was not used after 1923.(30)

Wastes Managed: In addition to receiving tank and process area drainage, acid sludges, asphalt sludges, tar sludges, and sludges containing tetraethyl lead are reported to have been disposed in this landfill.(1,3) Chemical analyses of the wastes were not available for this review.

Release Controls: Information on the unit's release controls was unavailable for this review.

History of Release: The location of Unit "I" has been redefined from a review of historical air photos. Previous soil and groundwater monitoring activities were conducted at the former location and are not representative of the new

unit location. As a result, the monitoring results previously reported for this site are not applicable according to Shell. The facility is scheduled to conduct soil sampling and groundwater monitoring at the new location of this unit.(30)

The area formerly occupied by this land disposal area was inspected during the VSI. The area has been paved and is now occupied by a truck loading area and parking lot. As a result, any past releases which may have occurred from this unit were not readily observable.(25)

4.3.2 Conclusions

Soil/Groundwater Release Potential: There is is a high potential for past soil and groundwater releases based on the design of this land disposal unit. It is unknown at this time if wastes or waste residues remain in the unit, and as such, the potential for ongoing releases to soil and groundwater cannot be evaluated.

Surface Water Release Potential: The potential for past releases to surface water cannot be evaluated because of lack of information regarding unit operations. Because the unit is covered with pavement, there is no ongoing release potential.

Air Release Potential: The potential for past air releases cannot be evaluated due to lack of information on unit operations. The unit is now closed and covered with paving; there is no potential for ongoing releases.

Subsurface Gas Release Potential: There was a moderate potential for the past generation of subsurface gas from this unit due to the unit design. It is unknown at this time if wastes or waste residues remain in the unit, and as a result, the potential for the ongoing generation of subsurface gas cannot be evaluated at this time.